Bones Well Picked

Author: Prothero, Donald R.

Source: BioScience, 59(3) : 264-265

Published By: American Institute of Biological Sciences

URL: https://doi.org/10.1525/bio.2009.59.3.12

the conference—improving relationships between ecologists and more traditional infectious disease specialists. This is a critical and needed step. If ecologists really want to understand the tension between themselves and "traditionalists," they should read the chapter by James E. Childs, who uses the recent foot-and-mouth disease outbreak in the United Kingdom as a case study, before they read the remainder of the book. With two short quotations, he shows just how far apart the two fields are. They demonstrate the wide divergence between what infectious disease ecologists claim they contributed and what an influential part of the veterinary community believes was added. This divide spills over, not surprisingly, even into terminology. The use of "disease," a phenotypic expression of infection, by ecologists makes an epidemiologist cringe. Interchanging prevalence and incidence—two quite different measures of infection—generates a similar reaction.

The two remaining chapters in this arena, by Karl M. Johnson and C. J. Peters, present fairly typical, descriptive overviews of disease systems in the form of case studies. Characterizing them as descriptive is not pejorative; they do capture the approach of traditional studies, in which there are typically a small number of pathogens whose actions and effects are summarized. What is evident from these chapters is just how better supported by data the descriptions of these specific systems are than those of most plant and animal systems. Consequently, we are left to wonder what would happen if epidemiologists applied ecological modeling to their systems. Sadly, this question wasn't addressed by the conference, and it would have been informative to include some epidemiologic modelers. After all, as early as the late 1960s and early 1970s, this group had conducted stochastic simulations of epidemics, characterized threshold population sizes, and evaluated intervention scenarios for disease outbreaks. This work was quite close to that of the ecological modelers at the conference.

The evolution of public health modeling away from these approaches would have been a useful adjunct to clarifying how the fields developed and how they might come together. As the editors note in the final chapter, however, ecologists face a challenge in finding ways to build conceptual-theoretical models that will be useful to human systems, not because they are inherently different but because the medical research community has different expectations. In that regard, the integration of ecological modeling with human diseases has shown tremendous progress in the years since the conference, which vindicates the editors' hopes. The creation of large-scale modeling efforts, whether focusing on strictly human diseases such as syphilis, gonorrhea, malaria, and measles, or pandemics of spillover pathogens such as avian influenza, demonstrates the tremendous vitality and growth of the field.

GREGORY E. GLASS
Gregory E. Glass (e-mail: gglass@jhsph.edu) is a professor in the W. Harry Feinstone Department of Molecular Microbiology and Immunology at Johns Hopkins Bloomberg School of Public Health in Baltimore.

BONES WELL PICKED

Major Transitions in Vertebrate Evolution. Jason S. Anderson and Hans-Dieter Sues, eds. Indiana University Press, 2007. 432 pp., illus. $49.95 (ISBN 9780253349262 cloth).

In this day of virulent creationist assaults on science, especially paleontology and evolutionary biology, it is valuable to have an up-to-date summary and synthesis of the important transitions in vertebrate evolution whose very existence the creationists must deny. *Major Transitions in Vertebrate Evolution,* edited by Jason S. Anderson and Hans-Dieter Sues, has its origins in a symposium at the 2003 Society of Vertebrate Paleontology meeting in St. Paul, Minnesota. Thus, unsurprisingly, it is a fairly technical volume aimed at the specialist audience, and assumes a fairly strong background in vertebrate paleontology, anatomy, and embryology. However, for those who have the training to understand the chapters, it is one of the most complete and current summaries of the topics discussed in the volume.

In an introductory chapter, the editors provide a background for the topics in the volume and a short summary and assessment of each contribution. The first full chapter is by Brian K. Hall and P. Eckhard Witten, who are both authorities on the anatomy and development of the vertebrate skeleton. Their chapter emphasizes the plasticity of the skeletal tissues of vertebrates, and how the simplistic categories of "bone," "cartilage," "dentine," and "enamel" break down when their detailed development is considered. They outline a continuum of intermediate tissues, such as chondroid, chondroid bone, cementum, and different kinds of dentine. They also point out that these tissues are highly plastic, and can be modified or even transformed into another tissue, depending on the dynamic stresses exerted upon them during the lifetime of a vertebrate. This research provides important insight into how such tissues first arose in vertebrates, and how their modification from one group to another is not as difficult as was once assumed.

The remaining chapters deal with issues of specific taxa and transitions between major vertebrate groups. Philippe Janvier offers a masterly summary of the origin of vertebrates, the current status of many primitive craniates and chordates (including the Cambrian vertebrates of China, the agnathans and the cyclostomes), and the issue of how vertebrate jaws arose (not from simple gill arches, as we have long been taught). Mark V. H. Wilson, Gavin F. Hanke, and Tiiu Märss examine the origin of paired fins in jawless vertebrates, basing their findings on the large number of new specimens that

doi:10.1525/bio.2009.59.3.12

show various combinations of fin folds, unpaired fins, and other features. Hans C. E. Larsson writes about MODEs (modules of developmental evolution) and discusses how such developmental modules might help us understand the skeletal features of the sarcopterygian fin. Jason S. Anderson reviews the evidence for how the embryology and development of modern amphibians helps us understand the phylogeny of the nonamniote tetrapods—according to his analysis, the lissamphibians are not all descendants of the dissorophids (only the frogs and salamanders are related to them; other groups apparently had origins in nontemnospondyl amniotes).

Robert R. Reisz reviews the status of the basal diadectomorphs and how they fit in the complicated transition from anthracosaurs to amniotes. Although his coverage was very thorough, I was a little surprised to find no mention of *Westlothiana* in the context of the most primitive known amniotes. Reisz sees the diadectomorphs as a monophyletic sister taxon to amniotes, closer than conventional anthracosaurs like *Seymouria* or *Gephyrostegus*. This implies some very long ghost lineages to account for the topology of his tree, which is no surprise since most anthracosaurs and diadectomorphs are known from the excellent specimens of the rich fossil beds of the Permian, yet the transition took place in the Early Carboniferous, from which well-preserved fossils were much less common.

Moving up into the amniotes, Michael W. Caldwell gives a review and update of the conflicting hypotheses on the origin of snakes, including some of the amazing complete Cretaceous specimens with vestigial limbs found since 1979. Luis M. Chiappe and Gareth J. Dyke review the controversies about the origin of birds, including the recent discoveries that further amplify and illuminate the "birds are dinosaurs" hypothesis. Naturally, their sympathies lie with the bird-dinosaur school of thought, but they do a good job of rebutting recent arguments by Feduccia, Martin, and others that birds are descended from some other group of archosaurs.

Although *Major Transitions in Vertebrate Evolution* is dedicated to Robert L. Carroll (who was a teacher or mentor to many of the contributors of the volume) and thus focuses mostly on the more primitive groups of amphibians and reptiles that he spent his career studying, there are also two chapters that review evolutionary transitions in mammals. Zhe-Xi Luo gives a broad overview of Mesozoic mammalian evolution, boiling down the much longer volume that he recently coauthored with Zofia Kielan-Jaworowska and Richard L. Cifelli (*Mammals from the Age of Dinosaurs: Origins, Evolution, and Structure,* Columbia University Press, 2004). This is a very valuable contribution, since the number of new specimens and the understanding of Mesozoic mammals has exploded in the past two decades. If you haven't kept up with it, there is much new material to learn (and unlearn). Finally, Mark D. Uhen briefly summarizes the now classic example of the origin of whales from terrestrial mammals. He gives summaries of nearly all the functional and ecological parameters as well, and compares them to primitive artiodactyls rather than to mesonychids. Surprisingly, he doesn't spend much time talking about the molecular evidence for whale-hippo affinities.

Major Transitions in Vertebrate Evolution is beautifully produced, with numerous color plates in the center, and typographical errors or problems in the reproduction of the halftones were very nearly absent. The volume is complete and up-to-date on the transitions within the vertebrates, although it does not give a complete picture because it focuses on the lower vertebrates. In particular, many more well-documented examples exist of transitional fossils in the synapsids, and especially within the placental mammals. These would have been nice to include in a complete volume, but at 422 pages of dense, technical text, it was probably too much to ask that this volume be comprehensive. However, any scientist who wants to get a quick update on the current thinking about the transitions mentioned above would do well to consult the chapters in this book.

DONALD R. PROTHERO
Donald Prothero (e-mail: prothero @oxy.edu) teaches in the Department of Geology at Occidental College in Los Angeles, California.

ACCOUNTING FOR NATURE

The Law and Policy of Ecosystem Services. J. B. Ruhl, Steven E. Kraft, and Christopher L. Lant. Island Press, Washington, DC, 2007. 360 pp., illus. $35.00 (ISBN 9781559630955 paper).

Two publications in 1997—*Nature's Services* (Daily 1997) and *The Value of the World's Ecosystem Services and Natural Capital* (Costanza et al. 1997)—brought significant attention and research focus to assessing the value of ecosystem services. Interest has grown steadily since then, and ecosystem services are now a central feature of discussions about conservation and sustainability. Indeed, ecosystem services were the central organizing theme of the Millennium Ecosystem Assessment (MEA 2005), and the World Bank, the US Environmental Protection Agency, and the Natural Capital Project (a partnership among the Nature Conservancy, World Wildlife Fund, and Stanford University), among others, have ongoing research programs on ecosystem services.

The vast bulk of the research on ecosystem services to date has focused on assessing the provision of ecosystem services, and thus concerns ecology and other natural sciences, and the value of ecosystem services, which brings in economics. Quantifying and valuing ecosystem services offer a clear and compelling way to demonstrate to policymakers and the general public the importance of conserving ecosystems. Before this information can bring about changes in human decisions affecting ecosystems, however, policymakers must recognize these values and institutionalize them in law and policy, and the general public must reflect these values in their every-

doi:10.1525/bio.2009.59.3.13